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Indian Standard

IS 1587 : 2017

एविएशन टर्बाइन ईंधन, उच्च फ्लैश बिंदु प्रकार — विशिष्टि

(चौथा पुनरीक्षण)

Aviation Turbine Fuel, High Flash Point Type — Specification

(Fourth Revision)

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Petroleum and Their Related Products of Synthesis or Biological Origin Sectional Committee, PCD 3

FOREWORD

This Indian Standard (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Petroleum and Their Related Products of Synthesis or Biological Origin Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This standard was originally published in 1960 and subsequently revised in 1967, 1976 and 1984. The third revision was prepared as a result of a review of the standard in the light of the requirements of the product, at that time and in order to align it with specification No. D. Eng. R. D. 2498 (issue 7), ‘Turbine fuel, aviation, high flash type’, issued by the Ministry of Defence, UK, which was in use during that time. JFTOT method was adopted in place of the CFR Coker method for the determination of thermal stability.

This revision has been done to update the standard with the present day requirements of the product and in order to align it with British Ministry of Defence specification DEF STAN 91-86 (DERD 2452) (Issue 6, 20 March 2009). The need for International Coordination among recognized standard of other countries on the subject is particularly significant for the product of this type since refueling of aircraft in different countries is often involved.

In this revision, the requirements for total sulphur, sulphur mercaptan, smoke point, distillation, thermal stability, flash point and water separation index have been modified. Additional requirements such as colour, particulate contamination, particulates at the point of manufacturing, refining components at the point of manufacturing and naphthalenes are included. The requirements for olefin content and oxidation stability have been deleted.

Further, Aircraft / Engine Fuel system components and fuel control units rely on the fuel to lubricate their moving parts. Lubricity (Wear Scar Diameter, mm) (*Max*) requirement requires to be defined in current revision. For Defence, this requirement to be met at 0.65 mm, *Max*.

The specification mandates the use of qualified and approved lubricity improver additive (LIA) and fuel system icing inhibitor (FSII) only. The approved additive systems namely, antioxidants, metal deactivators (MDA), lubricity improver additive (LIA) and fuel system icing inhibitor (FSII) have been adopted from DEF STAN 91-86 (DERD 2452) (Issue 6, 20 March 2009). Materials complying with the requirements of NATO code F-44, is qualified and permitted to be used as FSII.

Information regarding contamination by processing additives is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded value should be the same as that of the specified value in this standard.

Indian Standard

AVIATION TURBINE FUEL, HIGH FLASH POINT TYPE — SPECIFICATION

(Fourth Revision)

1 SCOPE

1.1 This standard prescribes requirements and the methods of sampling and test for kerosene type aviation turbine fuels, high flash point type, generally used by Navy on aircraft gas turbine engines on aircraft carrier.

1.2 This standard does not purport to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 REFERENCES

The listed standards as given in Annex B contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication the editions indicated were valid. All standards are subject to revision, and parties to agreements based on the standards are encouraged to investigate the possibility of applying the most recent editions of the standards.

3 REQUIREMENTS

3.1 Composition

The fuel shall consist of hydrocarbon compounds derived from conventional sources including crude oil, natural gas liquid condensates, heavy oil, oil shale and oil sands and the qualified additives specified in **3.1.1** to **3.1.4**.

3.1.1 *Antioxidants*

3.1.1.1 An approved antioxidant or mixture of antioxidants shall be added to a fuel (or a fuel component) which has been hydro processed (that is manufactured using a catalytic hydrogen process such as hydro treating, hydro fining, hydro cracking, etc). This shall be done immediately after hydro processing and prior to the product or component being passed into storage in order to prevent per-oxidation and gum formation after manufacture. The total concentration of active material(s) in fuel or that proportion of the fuel blend that has been hydro processed shall not be less than 17.0 mg/l nor exceed 24.0 mg/l. Where a finished fuel comprises a blend of hydro processed and non-hydro processed components, the requirements for mandatory addition of antioxidant applies only to that portion of the blend which has been hydro processed. In such cases the proportion of the blend which has been hydro processed shall be reported.

3.1.1.2 For fuel (or fuel component) which has not been hydro processed such addition is optional. However, the total concentration shall not exceed 24.0 mg/l. The following are some of the approved antioxidants:

a) 2, 6-ditertiary-butyl-4-methyl-phenol;
b) 2, 4-dimethyl-6-tertiary-butyl-phenol;
c) 2, 6-ditertiary-butyl-phenol;
d) A mixture consisting of 75 percent, *Min*, of 2, 6-ditertiary-butyl-phenol; and 25 percent, *Max*, of tertiary and tritertiary butyl-phenols;
e) A mixture consisting of 55 percent, *Min*, of 2, 4-dimethyl-6-tertiary-butyl-phenol; 15 percent, *Min*, of 4-methyl-2, 6-ditertiary-butyl-phenol; with the remainder, 30 percent, *Max*, a mixture of monomethyl and dimethyl-tertiary-butyl-phenols; and
f) A mixture consisting of 72 percent, *Min*, of 2, 4-dimethyl-6-tertiary-butyl-phenol and 28 percent, *Max*, mixture of tertiary-butyl-methyl-phenols and tertiary-butyl-dimethyl phenols.

3.1.2 *Metal Deactivator Additive (MDA)*

An approved metal deactivator, N, N2 -disalicylidene 1,2-propanediamine, may be added in amount not exceeding 2.0 mg/l on initial batching of the fuel at the refinery and 5.7 mg/l on cumulative addition, when re-doping the fuel to counteract the effects of metals known to be deleterious to thermal stability such as Cu, Cd, Co, Fe and Zn, provided that the nature of the contamination is reported. Where metallic contamination is unproven, MDA may be used to recover thermal stability provided that JFTOT Test [in accordance with Sl No. (vii) of Table 1] is determined before and after MDA addition and reported on the test certificate.

3.1.3 *Lubricity Improver Additive (LIA: previously cited as corrosion inhibitor/lubricity improver additive)*

A qualified LIA shall be added to the fuel to impart improved lubricity to the fuel. Because LIA exists in equilibrium with metal surfaces of fuel distribution systems as well as those of aircraft systems, correct delivery to aircraft can be assured only by equilibration of the supply system downstream of the LIA addition or by additive injection at the point of entry to the aircraft.

Some of the qualified lubricity improving additives along with their concentration in which they are added to the fuel at the time of delivery to the purchaser are as follows:

Sl No. (1)	*Product* (2)	*Manufacturer* (3)	*Quantity* mg/l (4)
i)	Apollo PRI-19	Apollo Technologies Intl.Corp	18-23
ii)	Hitec 580	Afton Chemical Ltd	15-23
iii)	Octel DCI-4A	Octel Starreon LLC	9-23
iv)	Octel DCI-6A	Octel Starreon LLC	9
v)	Nalco 5403	Nalco Chemical Co	12-23
vi)	Tolad 4410	Baker Petrolite	9-23

These are for guidance only.

NOTE — Doping of LIA is to be ascertained by refuelling agency during refueling. It is to establish lubricity requirement for Naval aircraft.

3.1.4 *Fuel System Icing Inhibitor (FSII)*

A qualified FSII shall be added to the fuel as agreed to between the purchasing authority and the supplier. Concentrations less than 0.02 percent by volume can be considered negligible and do not require agreement/notification. The assent to allow these small quantities of FSII without agreement/notification is to facilitate the changeover from fuels containing FSII where the additive may remain in the fuel system for a limited time. This does not allow the continuous addition of FSII at these low concentrations. Suitable methods for determining the additive concentration are IP 424 and ASTM D 5006.

The following material is qualified at the specified concentration as given below:

Product	*Concentration*
Diethylene Glycol Monomethyl Ether (DIEGME)	Not less than 0.12 percent and not more 0.15 percent by volume

NOTES

1 When LIA (*see* **3.1.3**) and FSII (*see* **3.1.4**) are to be used together it may found convenient to add the LIA in admixture with FSII. Whatever blending procedure is adopted, the supplier shall satisfy the purchaser that the correct concentration of LIA has been incorporated homogeneously. The supplier shall record the concentration of LIA and the information on the additives added shall be provided to the customer.

2 Doping of LIA and FSII is to be ascertained by refuelling agency during refueling. It is to establish lubricity requirement for Naval aircraft.

3.2 The material shall also comply with the requirements prescribed in Table 1.

3.3 The requirements contained in col 4 of Table 1 are absolute and not subject to correction for precision of test methods.

4 SAMPLING

4.1 Representative samples of material shall be drawn as prescribed in IS 1447 (Part 1).

4.2 Representative samples of each batch of the product shall be tested to prove homogeneity. On proving homogeneity, all characteristics given in the standard shall be tested on composite sample prepared by mixing representative samples, proportionately.

4.3 The lot shall be declared as conforming to the requirements of the standard if all the test results on the composite sample meet relevant standard requirements.

5 PACKING AND MARKING

5.1 Packing

The material shall be packed in suitable containers as agreed to between the purchaser and the supplier subject to any rules and regulations in force in the country.

5.2 Marking

The material shall be supplied in accordance with the marking and delivery instructions given by the purchaser.

5.2.1 Each container shall be marked with the following information:

a) Name of the material;
b) Indication of the source of manufacturer, initials or recognized trade-mark, if any;
c) Volume of the contents in litres;
d) Year and month of manufacture or packing; and
e) Any other statutory requirements.

5.2.2 *BIS Certification Marking*

The container may also be marked with the Standard Mark.

5.2.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

5.2.3 Each container shall also be marked with the caution label “Highly Flammable” together with the corresponding symbol for labeling dangerous goods [*see* IS 1260 (Part 1)].

6 HANDLING AND STORAGE

For the safe handling and storage of the fuel the instructions given in IS 7667 shall be followed.

Table 1 Requirement for Aviation Turbine Fuels, High Flash Point Type

(*Clauses* 3.1.2, 3.2 *and* 3.3)

Sl No.	Characteristic	Requirement	Method of Test, Ref to	
			[P:] of IS 1448	ASTM/IP/ISO
(1)	(2)	(3)	(4)	(5)
i)	*Appearance*			
	a) Visual appearance	Clear, bright and visually free from solid matter and un-dissolved water at ambient temperature	Visual	ASTM D 4176 (Procedure 1)
	b) Colour	Report (Note 1)	[P:14]	ASTM D156/ ASTM D6045
	c) Particulate contamination at point of manufacture, mg/l, *Max*	1.0 (Note 2)		ASTM D5452/ IP423
	d) Particulate at point of manufacture. Cumulative channel particle counts			IP 564/IP 565
	1) ≥ 4 µm (c)		Report (Note 3)	
	2) ≥ 6 µm (c)		Report	
	3) ≥ 14 µm (c)		Report	
	4) ≥ 21 µm (c)		Report	
	5) ≥ 25 µm (c)		Report	
	6) ≥ 30 µm (c)		Report	
ii)	*Composition*			
	a) Total acidity, mg KOH /g, *Max*	0.015	[P:113]	ASTM D3242/ IP 354
	b) Aromatics, % *v/v*, *Max*	25.0	[P:23]	ASTM D1319/ IP 156/ISO 3837
	c) Total Sulphur, % *m/m*, *Max*	0.1	[P:34]	ISO 8754/ISO 4260/ ISO 14596/ ASTM D 1266/ ASTM D 2622/ ASTM D 4294/ ASTM D 5453
	d) Sulphur Mercaptan, % *m/m*, *Max* Or	0.0020	[P:109]	ASTM D 3227/IP 342
	e) Doctor test	Negative (Note 4)	[P:19]	ASTM D4952/IP 30
iii)	f) Refining component at point of manufacture			
	1) Hydro processed component, % vol	Report		
	2) Severely hydro processed component, % vol	Report	(Note 5)	
	Volatility			
	a) Distillation		[P:18] (Note 6)	ASTM D86/ IP 123/ISO 3405
	1) Initial boiling point, °C	Report		
	2) 10 percent *v/ v* Recovery at, °C, *Max*	205.0		

Table 1 — (*Continued*)

Sl No.	**Characteristic**	**Requirement**	**Method of Test, Ref to**	
			[P:] of IS 1448	ASTM/IP/ISO
(1)	(2)	(3)	(4)	(5)
	3) 50 percent *v/v* Recovery at, °C	Report		
	4) 90 percent *v/v* Recovery at, °C	Report		
	5) Final Boiling Point, °C, *Max*	300.0		
	6) Residue, % *v / v*, *Max*	1.5		
	7) Loss, % *v / v*, *Max*	1.5		
	b) Flash point (PMCC), °C, *Min*	61.0	[P:21]	ASTM D93/IP 34/ IP 523
	c) Density at 15°C, kg/m^3	788.0 to 845.0	[P:16]	ISO 12185/ASTM D4052/IP 365/IP 160/ASTM D1298
iv)	*Fluidity*			
	a) Freezing point, °C, *Max*	– 46	[P:11]	ASTM D 5972/ IP 528/ IP 529/ ASTM D7153/ASTM D2386/IP 16
	b) Kinematic viscosity at – 20 °C, mm^2/s, *Max*	8.800	[P:25]	ASTM D445/IP 71/ ISO 3104
v)	*Combustion*			
	a) Specific energy, MJ/kg, *Min*	42.60	[P:6]	ASTM D 3338/ ASTM D 4809/ IP 12/ IP 355
	b) Smoke point, mm, *Min* Or	25.0	[P:31] (Note7)	ASTM D 1322/IP 598/ISO 3014 (Manual)
	c) Smoke point, mm, *Min* and Naphthalenes, % *v / v*, *Max*	19.0 3.00	[P:31] (Note 7) [P:118]	ASTM D 1322/IP 598 / ISO 3014 (Manual) /ASTM D1840
vi)	*Corrosion*			
	a) Copper strip corrosion for 2 hrs at 100 °C	Not worse than No.1	[P:15]	ASTM D130/IP 154
	b) Silver strip corrosion, *Max*	Zero (Note 8)		IP 227
vii)	*Thermal Stability*			
	JFTOT at control temperature of 260 °C			
	a) Filter pressure differential, mm Hg, *Max*	25	[P:97]	IP 323 (Note 9, 10)/ ASTM D3241
	b) Tube rating, visual,	Less than 3, No "Peacock" or "Abnormal" colour deposit		
viii)	*Contaminants*			
	a) Existent Gum, mg/100 ml, *Max*	7	[P:29] (Note 11)	IP 540
	b) Microseparometer rating at the point of manufacture and before addition of LIA, Rating, *Min*	85	[P:142] (Note 12)	ASTM D3948
	Lubricity: Wear scar diameter, mm, *Max*	0.65 (Note 13)		ASTM D 5001

NOTES

1 The requirement to report Saybolt Colour shall apply at point of manufacture, thus enabling a colour change in distribution to be quantified. Where the colour of the fuel precludes the use of the Saybolt Colour test method, then the visual shall be reported. Unusual or atypical colours should also be noted. For further information on the significance of colour (*see* Annex C).

2 Refer to the information on Particulate Contamination in Annex D.

3 The number of particles shall be reported as a scale number as defined by Table 1 of ISO 4406 : 1999.

Table 1 — (*Concluded*)

4 The mercaptan sulphur determination may be waived if the fuel is considered sweet by the Doctor test. However, in the event of a conflict between Sulphur Mercaptan ii(d) and Doctor test ii(e) results, requirement ii(d) shall prevail.

5 Severely hydroprocessed components are defined as petroleum derived hydrocarbons that have been subjected to a hydrogen partial pressure of greater than 7 000 kPa (70 bar or 1 015 psi) during manufacture. The severely hydroprocessed components shall be reported on the certificate of quality as a percentage by volume of the total fuel in the batch.

6 A condenser bath temperature of 0 to 4°C shall be used.

7 Existing [P : 31] method is under revision. Till such time, ISO 3014 shall be followed

8 This limit is applicable at the refinery stage. However, at the point of delivery in aircraft, a limit of 1 *Max*, is permitted by 4h test as per IP 227/99.

9 Examination of heater tube to determine the visual tube rating using the visual tuberator shall be carried out within 120 min of completion of the test.

10 Trace metal analysis is proposed only when the sample is failed in JFTOT test as per IS 1448 [P : 97].

11 Air may be used instead of steam as the evaporating medium so long as the temperatures remain as specified in [P : 29] of IS 1448, Table 1- Test conditions for Aviation Turbine Fuel, for steam jet apparatus. When carrying out this procedure, air flow calibration should be adjusted to give an air flow of 600 ml/s at ambient conditions. The beaker should still undergo the same pre-heating as in steam-jet procedure.

12 If the sample contains sediment or insoluble matter, it shall be allowed to stand and clear fuel decanted for testing. The sample shall not be filtered.

13 Irrespective of method of production of ATF, that is, Hydrotreated, Merox or mixed, lubricity in terms of WSD shall be reported in the Test Reports. If 'as is' WSD of ATF is greater than 0.65 mm at the point of production at the refinery, the desired WSD shall be obtained at the refineries after doping with the approved lubricity additive as mentioned in **3.1.3** and the quantity thus required to obtain WSD < 0.65 mm shall be annotated in the Batch Test Reports. If the quantity of LIA required for any of the batches of ATF at the refineries is found to be more than the stipulated maximum of the respective LIA as given in **3.1.3**, then such batches of ATF shall not be supplied by the refineries nor utilized by the Indian Armed Forces. For the batches of ATF of WSD > 0.65 mm, doping of optimized quantity of respective LIA stipulated by CEMILAC shall be mandatorily undertaken just before ATF is inducted into the aircraft. All activities of compliance in r/o doping and maintenance of relevant records for traceability point of view shall be vested solely by the supplier of ATF namely, AFS.

14 Alternate test methods are also available for various characteristics and in case of dispute the corresponding Parts of IS 1448, as given in Table 1 of this standard shall be the referee test method.

ANNEX A

(*Informative, Foreword*)

CONTAMINATION BY PROCESSING ADDITIVES

Experience has shown that refinery processing additives, such as corrosion inhibitors, might be carried over in trace quantities into aviation fuel during refinery production. In some cases, this has resulted in operational problems in aircraft fuel systems. Moreover, these additives can cause problems at levels which may not be detected by the standard specification testing as given in Table 1. Non-approved additives are not permitted but it is not straightforward to define a zero level, although it is accepted that:

a) modern analytical techniques are capable of detecting extremely low levels of chemical species,

b) there could be a wide range of materials involved, and

c) in most cases there are no data on their effects in aircraft systems to define a no-harm level.

It is therefore not practical for this standard to require detailed chemical analysis of each production batch of aviation fuel beyond the requirements listed in this standard. Instead, it is recommended that manufacturing locations ensure that they have adequate quality assurance and management of change procedures in place to ensure that refinery processing additive used is well defined and controlled. Any changes in additive composition/ manufacturing source or refinery processing conditions should be subject to a formal risk assessment to ensure maintenance of finished product quality. The purpose of this information is to highlight the effect of traces of additives on the overall performance of the fuel and to insist on the usage of Approved additives. It also advises the users to carry out formal risk assessment, in case there is a change in the manufacturing process, crude source, additive etc. This information given above is cautionary in nature.

ANNEX B

(*Clause* 2)

LIST OF CROSS REFERRED STANDARDS

Standard No.	*Title*
1260 (Part 1) : 1973	Pictorial marking for handling and labeling goods: Part 1 Dangerous goods (*first revision*)
1447 (Part 1) : 2000	Petroleum and its products — Methods of sampling: Part 1 Manual sampling (*first revision*)
1448	Methods of test for petroleum and its products:
[P : 6] : 1984	Calorific value by bomb calorimeter method (*first revision*)
[P : 11] : 2004/ ISO 3013 : 1997	Freezing point of aviation fuels (*fourth revision*)
[P : 15] : 2004/ ISO 2160 : 1998	Detection of copper corrosion from petroleum products by the copper strip tarnish test (*third revision*)
[P : 16] : 2014/ ISO 3675 : 1998	Density of crude petroleum and liquid petroleum products by hydrometer method (*fourth revision*)
[P : 18] : 1991	Distillation of petroleum products (*second revision*)
[P : 19] : 2015/ISO 5275 : 2003	Detection of thiols and other sulphur species — Doctor test (*second revision*)
[P : 21] : 2012/ISO 2719 : 2002	Flash point (closed) by Pensky Martens apparatus (*second revision*)
[P : 23] : 2004/ ISO 3837 : 1993	Hydrocarbon types in liquid petroleum products by fluorescent indicator absorption method (*fourth revision*)
[P : 25] : 1976	Determination of kinematic and dynamic viscosity (*first revision*)
[P : 29] : 2004/ ISO 6246 : 1995	Existent gum in fuels by jet evaporation (*third revision*)
[P : 31] : 1968	Smoke point
[P : 34] : 1979	Determination of sulphur in petroleum products (lamp method) (*second revision*)
[P : 42] : 2015/ISO 6250 : 1997	Determination of the water reaction of aviation fuels (*third revision*)
[P : 97] : 2015/ISO 6249 : 1999	Determination of thermal oxidation stability of gas turbine fuels — JFTOT method (*first revision*)
[P : 109] : 2004/ ISO 3012 : 1999	Determination of mercaptan sulphur amperometric and potentiometer methods for aviation turbine fuels (*first revision*)
[P : 113] : 1983	Determination of total acidity of aviation turbine fuel (ATF)
[P : 118] : 1985	Naphthalene hydrocarbons in aviation turbine fuels by UV spectrophotometry
[P : 142] : 1993	Determination of water separation characteristics of aviation turbine fuels by portable separometer
7667 : 1975	Code of practice for handling and storage of aviation fuels at airfield fuelling stations
ISO 8754	Petroleum products — Determination of sulfur content — Energy-dispersive X-ray fluorescence spectrometry
ISO 4260	Petroleum products and hydrocarbons — Determination of sulfur content — Wickbold combustion method
ISO 14596	Petroleum products — Determination of sulfur content — Wavelength-dispersive X-ray fluorescence spectrometry
ISO 12185	Crude petroleum and petroleum products — Determination of density — Oscillating U-tube method
ISO 4406	Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles
ISO 3014	Petroleum products — Determination of the smoke point of kerosine

Standard No.	*Title*
ASTM D 4176	Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)
ASTM D 156	Standard Test Method for Saybolt Color of Petroleum Products (Saybolt Chromometer Method)
ASTM D 6045	Standard Test Method for Color of Petroleum Products by the Automatic Tristimulus Method
ASTM D 5452	Standard Test Method for Particulate Contamination in Aviation Fuels by Laboratory Filtration
ASTM D 1319	Standard Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
ASTM D 1266	Standard Test Method for Sulfur in Petroleum Products (Lamp Method)
ASTM D 1552	Standard Test Method for Sulfur in Petroleum Products by High Temperature Combustion and IR Detection
ASTM D 2622	Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry
ASTM D 4294	Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry
ASTM D 5453	Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence
ASTM D 3227	Standard Test Method for (Thiol Mercaptan) Sulfur in Gasoline, Kerosine, Aviation Turbine, and Distillate Fuels (Potentiometric Method)
ASTMD 4052	Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
ASTM D 5972	Standard Test Method for Freezing Point of Aviation Fuels (Automatic Phase Transition Method)
ASTM D 7153	Standard Test Method for Freezing Point of Aviation Fuels (Automatic Laser Method)
ASTM D 3338	Standard Test Method for Estimation of Net Heat of Combustion of Aviation Fuels
ASTM D 4809	Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)
ASTM D 1322	Standard Test Method for Smoke Point of Kerosine and Aviation Turbine Fuel
ASTM D 5001	Standard Test Method for Measurement of Lubricity of Aviation Turbine Fuels by the Ball-on-Cylinder Lubricity Evaluator (BOCLE)
ASTM D 3241	Standard Test Method for Thermal Oxidation Stability of Aviation Turbine Fuels
ASTM D 445	Multicylinder Test Sequences for Evaluating Automotive Engine Oils: Part 3: Sequence V-D
ASTM D 5006	Standard Test Method for Measurement of Fuel System Icing Inhibitors (Ether Type) in Aviation Fuels
IP423	Determination of particulate contaminant in aviation turbine fuels by laboratory filtration
IP 424	Determination of fuel system icing inhibitor content of aviation turbine kerosines by high performance liquid chromatography
IP 564	Determination of the level of cleanliness of aviation turbine fuel — Laboratory automatic particle counter method
IP 565	Determination of the level of cleanliness of aviation turbine fuel — Portable automatic particle counter method

Standard No.	*Title*
IP 523	Determination of flash point — Rapid equilibrium closed cup method (ISO 3679 : 2004)
IP 365	Crude petroleum and petroleum products — Determination of density — Oscillating U-tube method
IP 342	Petroleum products — Determination of thiol (mercaptan) sulfur in light and middle distillate fuels — Potentiometric method
IP 528	Determination of the freezing point of aviation turbine fuels — Automated fibre optic method
IP 529	Determination of the freezing point of aviation fuels — Automatic laser method
IP 12	Determination of specific energy
IP 355	Petroleum products — Estimation of net specific energy of aviation turbine fuels using hydrogen content data
IP 227	Silver strip corrosion
IP 323	Test method for thermal oxidation stability of aviation turbine (JFTOT procedure)

ANNEX C

(*Table* 1, *Note* 1)

SAYBOLT COLOUR

B-1 Colour can be a useful indicator of fuel quality. Darkening of fuel or a change in fuel colour may be the result of product contamination or instability.

B-2 Changes in Saybolt Colour from the original Certificate of Quality for the batch would usually be cause for investigation as follows:

Initial Saybolt Colour at Point of Manufacture	*Significance Change*
> 25	> 8
≤ 25, but ≥ 15	> 5
< 15	> 3

B-3 Normally fuel colour ranges from water white (colourless) to a straw/pale yellow. Other fuel colours may be the result of crude oil characteristics or refining process. If unusual colours are produced at the point of manufacture, this should be noted on the batch certificate to provide information to downstream users. Unusual colours such as pink, red, green or blue that do not significantly impact the Saybolt Colour number should also be investigated to the cause.

ANNEX D

(*Table* 1, *Note* 2)

PARTICULATE CONTAMINATION

C-1 The visual appearance of the product is a good indication of contamination and remains a key requirement for fuel throughout the distribution system. However, interpretation of the Appearance requirement can lead to problems due to the subjective nature of the visual assessment. Therefore, a quantitative limit has been established for particulate contamination. A maximum particulate contamination of 1.0 mg/l, when tested to IP 423/ ASTM D 5452, shall apply at point of manufacture only.

C-2 Fuels containing visual particulate or with particulate levels greater than 1.0 mg/l will require additional handling procedures, such as extended settling and/or filtration.

C-3 Where fuel is being delivered into aircraft, the IATA Guidance Material for Aviation Turbine Fuels Part III — Cleanliness and Handling, shall be referred to for appropriate information on contamination limits.

C-4 It is the intent of the Specification Authority to extend particulate contamination limits throughout the distribution system at a later date.

Bureau of Indian Standards

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Review of Indian Standards

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